APPENDIX C

Calculation of the Standard Deviational Ellipse

The standard deviational ellipse is derived from the bivariate distribution (Ebdon, 1988):

Bivariate Distribution $= SQRT \dfrac{\sigma^2{}_x + \sigma^2{}_y}{2}$ Equation 1

The standard deviational ellipse is calculated in two steps (Ebdon, 1988). In the first step, the orientation of the axes of the ellipse is determined by minimizing the sum of squares of the distances between the building locations and the x and y:

$$\theta = Arc\tan \frac{\left[\left(\sum_{i=1}^{N}(x_i-\bar{x})^2 - \sum_{i=1}^{N}(y_i-\bar{y})^2\right) + \left\{\left(\sum_{i=1}^{N}(x_i-\bar{x})^2 - \sum_{i=1}^{N}(y_i-\bar{y})^2\right)^2 + 4\left(\sum_{i=1}^{N}(x_i-\bar{x})(y_i-\bar{y})\right)^2\right\}^{1/2}\right]}{2\sum_{i=1}^{N}(x_i-\bar{x})(y_i-\bar{y})}$$

Equation 2

The y-axis is rotated clockwise through angle θ. The standard deviations are then calculated using the rotated x- and y-axes:

$$S_x = \sqrt{\left\{2\sum_{i=1}^{N}\left[(x_i-\bar{x})\cos\theta-(y_i-\bar{y})Sin\theta\right]^2 \Big/ N-2\right\}}$$

Equation 3

$$S_y = \sqrt{\left\{2\sum_{i=1}^{N}\left[(x_i-\bar{x})\sin\theta-(y_i-\bar{y})\cos\theta\right]^2 \Big/ N-2\right\}}$$

Equation 4